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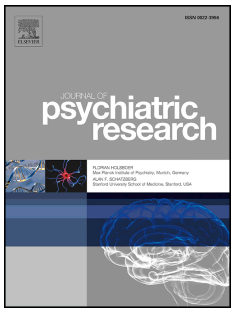

Depression, sleep problems, and perceived stress among informal caregivers in 58 low-, middle-, and high-income countries: A cross-sectional analysis of community-based surveys

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Title: Depression, sleep problems, and perceived stress among informal caregivers in 58 low-, middle-, and high-income countries: a cross-sectional analysis of community-based surveys

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Abstract

Caregiving has been associated with adverse health outcomes. However, there is a paucity of multi-country, population-based studies on mental health outcomes of caregivers especially from low- and middle-income countries (LMICs). Thus, we assessed the association of caregiving with depression, sleep problems, and perceived stress in 10 high-, 27 middle-, and 21 low-income countries. Cross-sectional community-based data of the World Health Survey including 258,793 adults aged ≥18 years were analyzed. Multivariable logistic and linear regression analyses were conducted to explore the association of past 12-month caregiving with past 12-month DSM-IV depression, and past 30-day perceived stress [range 0 (low)-100 (high)] and severe/extreme sleep problems. Nearly 20% of the individuals were engaged in caregiving with particularly high rates observed in high-income countries (HICs) (e.g., Finland 43.3%). Across the entire sample, after adjustment for potential confounders, caregivers had a significantly higher likelihood of having depression (OR=1.54; 95%CI=1.37-1.73), sleep problems (OR=1.37; 95%CI=1.25-1.50), while their mean perceived stress score was 3.15 (95%CI=2.46-3.84) points higher. These associations tended to be stronger in HICs. A greater number of caregiving activities was associated with a greater likelihood of depression, sleep problems, and perceived stress regardless of country income levels. In conclusion, caregiving has a negative impact on mental health worldwide with possibly greater effects in HICs. Given the growing contribution of caregivers in long-term care, interventions and policies to alleviate the mental health burden of caregivers are urgently needed to maintain sustainable and effective care practices.

Keywords: Depression; Sleep; Stress; Caregiving

Introduction

Population aging is occurring at an unprecedented speed globally as a result of increasing life expectancy and decreasing fertility (Lutz et al., 2008). Between 2015 and 2050, the population of older adults is expected to more than double in size, reaching nearly 2.1 billion. The older population is expanding particularly rapidly in developing regions where two thirds of the world's older people reside (United Nations, 2015).

While people now live longer, they are also living for more years with disability (GBD 2015 DALYs and HALE Collaborators, 2016). This is expected to drastically increase the number of individuals in need of care, which requires a substantial increase in the quantity of caregivers. This increasing need for care is not only for the older population. Children with complex disabilities also now live longer as the result of medical advances, and may even outlive their parents (Talley and Crews, 2007). Although the growing need for long-term care (LTC) policies has generally been considered in the context of industrialized countries, the LTC needs in the developing world are increasing at a much faster rate, while this need is emerging in a much more socioeconomically disadvantaged context (World Health Organization, 2003). Therefore, the establishment of sustainable and effective LTC policies is one of the most pressing issues facing modern society globally.

Worldwide, the vast majority of individuals living with disabilities due to long-term illness or old age are provided unpaid support and assistance from relatives or friends (informal care) (World Health Organization, 2003). At any given time, one out of four people acts as an informal caregiver, and half of these are likely to provide over 20 hours of care per week at some point in their life (Hirst, 2002). Informal care is a crucial alternative to otherwise expensive health care services and institutional care. For example, in the UK, the value of informal adult care in 2010 was £61.7 billion (Office for National Statistics, 2013), while the financial contribution of informal caregivers is estimated to be 50%-90% of the

overall LTC costs in Europe (Athens/Vienna: European Commission, 2010). However, the supply of informal caregivers is decreasing due to factors such as low fertility and smaller families, migration, and more female employment (Heitmueller and Inglis, 2007; Lamura et al., 2008). Governmental budget decreases in health care are also imposing a large burden on the decreasing number of informal caregivers (Morris, 2004). In developing countries, where health and welfare services are scant, it is likely that there is a particularly heavy reliance on informal care (Prince, 2004).

The health of the caregiver is vital to sustain informal care provision. For example, depression in caregivers often leads to the institutionalization of the care recipient (Colerick and George, 1986), which is costly at both individual and societal levels. In addition, poorer physical and mental health of the caregiver has been associated with harmful informal caregiver behavior (Beach et al., 2005; Lin and Giles, 2013). However, studies conducted mainly in high-income countries (HICs) have demonstrated that caregivers are more likely to have physical diseases and, in particular, mental health problems. Caregiving strain has been associated with a 1.63 times higher risk of caregiver death (Schulz and Beach, 1999).

Stress-related conditions and depression are the most frequent mental health problems reported among caregivers (Pinquart and Sörensen, 2003), while sleep problems are also common (McCurry et al., 2015). Chronic sleep problems and depression in the context of stressful long-term caregiving responsibilities may also increase risk for physical health problems (McCurry et al., 2015; Xiang and An, 2015). Stress may arise not only from the act of caregiving but also from the costs associated with providing care and financial cost of lost working hours (Carter, 2008). A previous study has shown that a substantially higher proportion of income may be lost as a result of caregiving in low- and middle-income countries (LMICs) compared to HICs (Viana et al., 2013).

Despite this, very little is known about dispensation of LTC and its impact on mental

health in LMICs. Furthermore, multicountry studies including LMICs are scarce (Shahly et al., 2013) despite potentially different circumstances surrounding caregivers between countries (e.g., quality of social service, family size, underlying disease of the care recipient). Community-based data is also sparse and most previous studies have focused on caregiving for patients affected by a particular disease (e.g., cancer, dementia), thereby limiting generalizability. To our knowledge, two previous multicountry, general population studies of the World Mental Health Surveys examining family burden related to caregiving included data on 9-10 LMICs (Shahly et al., 2013; Viana et al., 2013). However, the only mental health outcome assessed was psychological distress.

Thus, given the complete lack of studies on the association of caregiving with depression, sleep problems, and perceived stress from a global perspective, we used data on 258,793 adults aged ≥18 years from predominantly nationally representative samples of 10 HICs, 27 middle-income countries (MICs), and 21 low-income countries (LICs) which participated in the World Health Survey (WHS), to obtain a worldwide understanding on the prevalence of caregiving, and its associated mental health burden.

Methods

The survey

The WHS was a cross-sectional survey conducted in 70 countries in 2002-2004. Survey details are available from the WHO (http://www.who.int/healthinfo/survey/en/). Briefly, single-stage random sampling was carried out in 10 countries, while the remaining 60 countries used stratified multi-stage random cluster sampling. All adults aged ≥18 years with a valid home address were assigned a non-zero chance of inclusion. Standard translation procedures for the survey questionnaire were followed to ensure comparability across countries. Face-to-face interviews and telephone interviews were conducted by trained

interviewers. Individual level response rates were over 82%. Post-stratification corrections were made to sampling weights to adjust for non-response and the population distribution reported by the United Nations Statistical Division.

Data from 69 countries were publicly available but we excluded 11 countries for a lack of sampling information or data on caregiving. Thus, 58 countries constituted the final analytical sample (n=258,793). According to the World Bank classification in 2003 (at the time of the survey), 10 (n=15,841), 27 (n=137,666), and 21 (n=105,286) countries were HICs, MICs, and LICs, respectively. The list of the countries included in the current study is provided in **Table 1**. The data were nationally representative for all countries with the exception of China, Comoros, the Republic of Congo, Ivory Coast, India, and Russia.

Ethical boards at each study site provided approval for the survey with informed consent being obtained from all participants after the nature of the procedure has been fully explained. The investigation was carried out in accordance with the latest version of the Declaration of Helsinki.

Variables

Caregiving (Exposure variable)

Those who answered affirmatively to the question "During the past year, did you provide help to a relative or friend (adult or child), because this person has a long-term physical or mental illness or disability, or is getting old and weak?" were considered to be caregivers (Hosseinpoor et al., 2013). This question is comparable to those used in previous surveys to identify caregivers (Smith et al., 2014). Furthermore, questions on five types of caregiving activities (personal care, medical care, household activities, supervision, transport/mobility) with "Yes" and "No" options were asked to caregivers (See **eTable 1** of the Appendix for

actual questions). The number of caregiving activities was summed. Non-caregivers were assigned a score of 0.

Depression (Outcome variable)

Depression was assessed with the DSM-IV algorithm based on duration and persistence of depressive symptoms in the past 12 months (Cifuentes et al., 2008; Loerbroks et al., 2012). The algorithms used are provided in **eTable 2** (Appendix).

Sleep problems (Outcome variable)

Sleep problems were assessed by the question "Overall in the last 30 days, how much of a problem did you have with sleeping, such as falling asleep, waking up frequently during the night or waking up too early in the morning?" with answer options none, mild, moderate, severe, and extreme. As in previous WHS publications, those who answered severe and extreme were considered to have sleep problems (Koyanagi et al., 2014; Koyanagi and Stickley, 2015; Stranges et al., 2012).

Perceived stress (Outcome variable)

The two questions used to assess perceived stress over the month prior to the interview were "How often have you felt that you were unable to control the important things in your life?" and "How often have you found that you could not cope with all the things that you had to do?" with answer options: never (score=1), almost never (score=2), sometimes (score=3), fairly often (score=4), very often (score=5). These two questions were taken from the Perceived Stress Scale (Cohen et al., 1983) which has been validated and applied in many settings worldwide, including LMICs (Hamad et al., 2008). In line with a previous publication using the same dataset, factor analysis with polychoric correlations was

conducted to obtain a factor score which was later converted to scores ranging from 0-100 with higher values representing higher levels of perceived stress (Vancampfort et al., 2017).

Control variables

The selection of the control variables used in this analysis was based on past literature and included age, sex, marital status (married/cohabiting, never married, separated/divorced/widowed), wealth, highest education attained (no formal education, primary education, secondary or high school completed, and tertiary education completed), household size (1, 2, 3-5, ≥6), employment status (not working for pay or currently in paid employment), and disability (Hosseinpoor et al., 2013; Smith et al., 2014). Age was categorized as 18-44 (young adults), 45-64 (middle-aged adults), and ≥65 (older adults) years, which broadly represent distinct life stages (Timsina et al., 2017). Country-wise wealth quintiles were created using principal component analysis based on 15-20 assets. Individuals who had severe/extreme difficulty in either moving around, performing self-care, concentrating/remembering things, or seeing and recognizing a person across the road in the past 30 days were considered to have disability (Mitra and Sambamoorthi, 2013).

Statistical analysis

Statistical analyses were performed with Stata 14.1 (Stata Corp LP, College station, Texas). Differences in unadjusted estimates were tested with Chi-squared tests and Student's *t*-tests for categorical and continuous variables, respectively. Multivariable regression analysis was conducted to assess the association of caregiving (exposure variable) with depression, sleep problems (logistic regression) and perceived stress (linear regression) as the outcomes. Analyses stratified by age groups (18-44, 45-64, ≥65 years) and by country income level were also conducted. These analyses adjusted for age (apart from the age-stratified analysis),

sex, marital status, wealth, education, household size, employment status, disability, and country. Adjustment for country was conducted by including dummy variables for each country as in previous WHS publications (DeVylder et al., 2016; Koyanagi and Stickley, 2015; Vancampfort et al., 2017). We repeated similar analyses with number of caregiving activities as the exposure variable.

Next, given that perceived stress, depression, and sleep problems are likely to be interrelated and can potentially give rise to the other condition, we conducted mediation analysis to assess the extent to which the association between caregiving and the mental health outcome (e.g., depression) can be explained by the other two mental health problems (e.g., perceived stress and sleep problems) using the overall sample and samples by country income levels. We used the *khb* (Karlson Holm Breen) command in Stata for this purpose (Breen et al., 2013). This method decomposes the total effect (i.e., unadjusted for the mediator) of a variable into direct (i.e., the effect of caregiving on the mental health outcome adjusted for the mediator) and indirect effects (i.e., the mediational effect). Using this method, the percentage of the main association explained by the mediator can also be calculated (mediated percentage). The mediators were the other two mental health problems with their individual contribution to the overall mediated percentage also being calculated. The mediation analysis adjusted for age, sex, marital status, wealth, highest education attained, household size, employment status, disability, and country.

Finally, to assess the generalizability of the findings based on the pooled sample across all countries, we conducted country-wise regression analyses for the association between caregiving and the three outcomes (depression, sleep, perceived stress) adjusting for age and sex. A pooled estimate was obtained by meta-analysis with random effects. To assess the level of between-country heterogeneity, the Higgins' I^2 statistic was calculated. This represents the degree of heterogeneity that is not explained by sampling error with a value of

<40% often considered as negligible and 40-60% as moderate heterogeneity (Higgins and Thompson, 2002).

Brazil, Hungary, and Zimbabwe were not included in the analysis with perceived stress as the outcome as this information was not available. Furthermore, only two HICs (Spain and United Arab Emirates) were included in the analysis on number of caregiving activities, as this data was not collected in other HICs. All variables were included in the models as categorical variables with the exceptions of perceived stress and the number of caregiving activities (continuous variables). Taylor linearization methods were used in all analyses (apart from unweighted frequencies) to account for the sample weighting and complex study design. The level of statistical significance was $p<0.05$.

Under 5% of the values were missing for all variables used in the analysis with the exception of caregiving (6.1%), perceived stress (6.1%), number of caregiving activities (7.0%), depression (7.2%), wealth (9.3%), and employment status (14.8%). In order to assess whether these missing values lead to biased estimates, we repeated the analysis by conducting multiple imputation of missing values using the *mi* commands in Stata using chained equations (10 imputations). Since the results of the analysis with and without imputed data were similar, we only present the non-imputed results.

Results

The mean (SD) age of the sample was 39.0 (16.4) years with 50.8% of the sample being females. The age distribution was as follows: 18-44 years (63.7%; n=158,832); 45-64 years (24.9%; n=62,148); ≥65 years (11.4%; n=28,409). The prevalence of caregiving overall was 19.6% (95%CI=19.1%-20.1%) with the highest prevalence observed in HICs [24.3% (95%CI=22.3%-26.5%)], followed by MICs [23.7% (95%CI=23.0%-24.4%)] and LICs [15.9% (95%CI=15.2%-16.6%)]. Overall, of those engaged in caregiving activities, the

average number of caregiving activities was 2.7 (SD 1.5). Caregivers in HICs were more likely to be older, have higher education, and live in smaller households (Appendix **eTable 3**). The prevalence of caregiving ranged from 8.4% (Pakistan) to 43.3% (Finland) (**Table 1, Figure 1**).

The overall prevalence of depression was 7.1% [6.4% (non-caregivers) vs. 10.1% (caregivers); Chi-squared test p<0.0001], while the corresponding figure for sleep problems was 7.6% [7.1% (non-caregivers) vs. 9.9% (caregivers); Chi-squared test p<0.0001]. The mean perceived stress score was 1.61 points higher in caregivers compared to non-caregivers (Student's *t*-test p=0.0003). Overall, caregiving was more common among those with the following characteristics: middle-age, female sex, married/cohabiting, in paid employment, have some form of disability, higher levels of wealth and education, and household size of two (**Table 2**). The prevalence of each sample characteristic by caregiving status is presented in **eTable 4** of the Appendix.

Association between caregiving and mental health outcomes (overall and by age and country income level)

In the overall sample, caregiving was associated with significant 1.54 and 1.37 times higher odds for depression and sleep problems, respectively, while the mean stress score was 3.15 points higher (p<0.0001) (**Table 3**). The association was strongest for HICs for all three outcomes. The age-stratified analysis showed that in the overall sample, the strongest association is observed in the middle-aged for depression, and the youngest for sleep problems and perceived stress. Similar patterns were observed for all country income levels with the exception of MICs for depression where the highest OR was observed in the youngest age group, and perceived stress for HICs and LICs where the strongest associations were observed among the oldest. The mediation analysis showed that for all the three mental

health outcomes, their association with caregiving was not largely influenced by the other two mental health problems across all country income levels as evidenced by the strong direct effects (Appendix **eTable 5**).

Association between number of caregiving activities and mental health outcomes (overall and by country income level)

Increasing numbers of caregiving activities were associated with significantly increased odds for depression and sleep problems as well as higher mean perceived stress scores in the overall and country income level specific samples (**Table 4**).

Country-wise association between caregiving and mental health outcomes

The country-wise analysis showed that caregiving is associated with increased odds for depression, sleep problems, and higher perceived stress scores in the majority of countries although a moderate level of between-country heterogeneity was observed (Higgin's I^2 43.4%-58.4%) (Appendix **eFigure 1**, **eFigure 2**, **eFigure 3**). The pooled estimates obtained by meta-analysis were similar to those reported in Table 3.

Discussion

Main findings

Nearly 20% of adults in the 58 countries included in our study were engaged in caregiving activities with particularly high rates observed in HICs (e.g., Finland 43.3%, Luxembourg 40.3%). Overall, caregivers had a significantly increased likelihood of having depression, sleep problems, and higher levels of perceived stress, with the strongest associations observed in HICs. Caregiving was more strongly associated with sleep problems among the younger age group across all samples but there were no consistent age patterns for depression

and perceived stress. Greater numbers of caregiving activities increased the odds for depression and sleep problems as well as the mean perceived stress score regardless of the country income level. Country-wise analyses showed that the findings are generalizable to the majority of countries although a moderate level of between-country heterogeneity was observed.

Interpretation of main findings

Our findings that caregiving is associated with higher risks for adverse mental health outcomes are in line with previous studies (McCurry et al., 2015; Pinquart and Sörensen, 2003) including the few mainly small single-country studies from LMICs which have focused on caregiving for certain diseases (Kamel et al., 2012; Laks et al., 2016; Lehan et al., 2012; Liu et al., 2016; Sanyal et al., 2015). The psychological health of the caregivers may be negatively affected by factors such as: (a) difficult and stressful caregiving tasks; (b) restrictions in personal life; (c) social isolation; (d) economic loss due to caregiving including foregone earning opportunities; (e) illness-specific problems of the care recipient (e.g., aggression in dementia patients); and (f) the uncertainty in terms of the progression of the care receiver's illness and duration of care (Pinquart and Sörensen, 2003; Sörensen et al., 2006). Stressors often accumulate because the assistance needed exceeds the physical and mental capacity of the caregiver and eventually become a chronic stress factor (Zarit, 1998). Sleep may be disrupted in caregivers for the illness-specific problems of the care recipient occurring at night (e.g., nocturnal incontinence, wandering at night, hallucinations, and agitation), or the worry for the care-recipient's health and monitoring (McCurry et al., 2015). Insomnia may also increase risk for mental disorders such as depression (Breslau et al., 1996) which in turn may act to aggravate insomnia. The finding that higher numbers of caregiving

activities were linearly associated with worse mental health outcomes provides evidence for a cumulative burden of caregiving activities.

The prevalence of caregiving was highest in HICs and the associations of caregiving with depression, sleep problems, and perceived stress were also strongest in this setting. Country-wise analyses showed that caregivers in Scandinavian countries such as Sweden and Finland have one of the highest odds for sleep problems, and that caregiving was most stressful in Sweden. This finding may be surprising given that formal care services are more widely available in HICs, particularly in Scandinavia (Di Novi et al., 2015), compared to LMICs. Although the reason for this is not clear, several hypotheses may be proposed. For example, factors such as fewer siblings to share the workload of caring for the parents (Chen, 2016), and longer life with disability among care recipients in HICs (GBD 2015 DALYs and HALE Collaborators, 2016), which can result in more intense caregiving activities, may underlie our findings. Indeed, in a previous multicountry study, the prevalence of family health problems, and family burden (time, financial, distress) due to caregiving was higher in HICs compared to LMICs (Viana et al., 2013). Next, it may also be that caregivers in HICs are more likely to be caring for dementia patients (Ferri et al., 2005), which has been reported to be particularly distressful (Clipp and George, 1993). However, our HIC sample mainly consisted of European countries and it is unclear whether our findings apply to other HIC settings such as the USA, Japan, or Australia. Thus, future studies including a more diverse set of countries are warranted before definite conclusions can be drawn regarding our finding on HICs.

In terms of the age patterns, sleep problems were consistently associated with younger age, but for depression and stress, no distinct patterns emerged. Caregiving at younger ages may have a more negative psychological effect by conflicting with education, potential careers paths, and income-generating activities, while these are unlikely to be affected in old

age. Also, the care recipient may differ by age groups. For example, older people may be more likely to be caring for their spouses, while care recipients may more often be parents for younger individuals. Kinship status has been shown to affect family burden differently (Viana et al., 2013). The particularly high odds for depression in the middle-aged in HICs may be related to the fact that this generation is likely to be faced with a dual task of caring for their children and parents especially in HICs where late childbearing is common. Finally, the higher level of perceived stress in the oldest caregivers observed in some settings may be partly explained by the additional burden incurred due to their own health problems and functional limitations, while they also may have fewer coping resources (Pinquart and Sörensen, 2003).

Implications of the findings

The high prevalence of caregiving compounded with high risk for adverse mental health outcomes especially in some settings (e.g., HICs) suggests that caregiving may be having a large population-level negative impact on mental health. The results of the mediation analysis suggest that targeting a single mental health problem may only have a limited effect in preventing other mental health outcomes, and that interventions should target the mental health outcomes individually or simultaneously across all country income levels. Strategies to prevent depression is particularly imminent, given that the World Health Organization has recently announced that depression is now the leading contributor to years lived with disability across all diseases globally (World Health Organization, 2017). It is possible that effective care policies could substantially improve conditions for caregivers, thereby significantly reduce an otherwise alarming downward trend in global mental health.

Early identification of individuals with caregiving responsibilities, for which general practitioners or gerontologists may play a pivotal role, is important to take measures to

maintain the physical and mental health of caregivers. 'Quick tools' can be used to assess the psychological needs as well as strain and burden among caregivers (Cameron et al., 2011). A meta-analysis of caregiver intervention studies found that psychotherapy and psychoeducation are particularly effective in improving caregivers' burden, depression, and wellbeing (Sorensen et al., 2002). In terms of sleep, cognitive behavioral therapy, relaxation, and mindfulness training have been shown to improve sleep in caregivers (McCurry et al., 2015). Furthermore, physical activity is known to be effective to improve symptoms of depression (Schuch et al., 2016) and anxiety in people with stress related disorders (Stubbs et al., 2017) in the general population. There is also emerging evidence that physical activity interventions can improve wellbeing, quality of life and sleep in caregivers (Lambert et al., 2016). Small randomized controlled trials have suggested that interventions may also be possible and effective in LMICs for caregivers (Dias et al., 2008; Gavrilova et al., 2009; Guerra et al., 2011). These studies, conducted in India, Russia, and Peru, have found that the 10/66 Dementia Research Group's 'Helping Carers to care' intervention can relieve carer strain and/or reduce psychological morbidity. Other interventions such as carer compensatory benefits, respite care, disability benefits for the care recipients, and use of paid carers may also reduce caregiver burden (Prince, 2004; World Health Organization, 2003), and by extension lead to better psychological well-being.

In summary, an effective solution could lie in a holistic, multidisciplinary, and inter-sectorial care approach. Such an approach is vital in creating solutions for health systems that would be sustainable not only in financial terms, but also beneficial for the health of informal caregivers and the care recipient. The obvious benefits that can be gained from what is, essentially, unpaid care, can significantly contribute to sustainability if health systems are willing and committed to taking the appropriate intervention steps. In LMICs, there is a

particular need to carefully plan interventions and policies in the context of financial constraints.

Strength and limitations

The strength of this study is the very large sample size and the use of predominantly nationally representative multi-country data including a large number of LMICs. To the best of our knowledge, this is the first study to assess the association of caregiving with depression, sleep problems, and perceived stress across developed and developing countries. The data should nonetheless be interpreted in the light of several limitations. First, the survey relied on self-report, thus reporting bias may exist (e.g., social desirability, recall). Second, the selection of the countries which participated in the WHS was not at random but rather based on convenience. Furthermore, only two HICs were included in the analysis on the number of caregiving activities and the mental health outcomes. Thus, our results may not be generalizable to all HICs or LMICs. Third, we did not have information on caregiving intensity or duration, financial loss associated with caregiving, or the characteristic of the care recipient. In relation to this, it is possible that our estimates for mental health outcomes are conservative given that individuals with very little involvement in caregiving may have been considered to be caregivers. Moreover, the data were collected between 2002 and 2004 and therefore, may not reflect the current situation in some countries. Finally, the cross-sectional design limits the potential for causal inferences.

Conclusions

The global demographic trend predicts a continued and increasing demand for informal caregiving. However, due to the indirect costs associated with care, primarily productivity loss, and adverse health outcomes, health systems face a difficult situation regarding the

utilization of informal care as a sustainable solution worldwide. In particular, our findings that caregiving is associated with negative mental health outcomes globally raises serious concerns regarding the functional integrity and sustainability of such a system. It is also possible that mental health problems related with caregiving are incurring important additional societal costs for lost productivity and treatment costs. Future studies, ideally of longitudinal design, that assess the factors that predispose caregivers to mental health problems, are warranted to design specific targeted interventions or to inform policy.

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Table 1 Prevalence of caregiving (overall and by subgroups of age and sex)

				Age (years)						Sex			
		Overall		18-44		45-64		≥65		Female		Male	
Country	N[a]	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Low-income countries													
Bangladesh	5942	17.5	(0.9)	18.4	(1.0)	17.2	(1.4)	5.9	(1.5)	17.5	(0.9)	17.4	(1.2)
Burkina Faso	4948	17.9	(1.4)	17.6	(1.6)	21.6	(2.0)	12.6	(2.6)	18.1	(1.4)	17.8	(1.8)
Chad	4870	16.1	(1.1)	16.7	(1.2)	17.0	(1.8)	6.0	(1.5)	11.9	(1.1)	20.6	(1.5)
Comoros	1836	15.8	(1.4)	17.6	(1.8)	16.1	(1.9)	6.5	(1.6)	13.6	(1.4)	18.1	(2.1)
Ethiopia	5089	10.9	(0.7)	11.1	(0.8)	10.2	(1.2)	10.7	(2.2)	9.7	(0.9)	12.1	(1.0)
Ghana	4165	10.7	(0.7)	10.4	(0.9)	12.8	(1.3)	8.1	(1.8)	10.2	(0.9)	11.3	(1.1)
India	10687	17.3	(0.9)	19.0	(1.0)	15.6	(1.5)	9.4	(1.6)	16.4	(1.0)	18.0	(1.1)
Ivory Coast	3251	16.1	(1.2)	17.0	(1.3)	14.9	(2.1)	7.1	(2.2)	15.2	(1.5)	16.8	(1.5)
Kenya	4640	25.1	(1.2)	24.6	(1.3)	28.5	(2.9)	21.9	(3.4)	22.4	(1.3)	27.8	(2.2)
Laos	4988	21.5	(0.9)	21.7	(1.0)	22.9	(1.5)	15.2	(2.6)	22.2	(1.1)	20.7	(1.2)
Malawi	5551	18.0	(0.8)	18.2	(1.0)	19.7	(1.3)	11.8	(1.8)	18.4	(1.2)	17.6	(1.2)
Mali	4886	15.3	(1.0)	15.6	(1.2)	15.6	(1.5)	10.3	(2.0)	11.6	(1.3)	19.5	(1.2)
Mauritania	3902	20.8	(1.9)	22.1	(2.2)	19.2	(2.5)	10.2	(3.0)	18.2	(1.8)	23.4	(2.5)
Myanmar	6045	22.1	(1.8)	22.3	(1.9)	23.7	(2.3)	15.8	(2.1)	23.0	(1.9)	21.3	(2.0)
Nepal	8820	27.8	(0.6)	30.9	(0.8)	23.5	(1.1)	9.7	(1.1)	23.9	(0.7)	31.6	(1.1)
Pakistan	6501	8.4	(0.5)	8.9	(0.7)	7.2	(0.9)	7.0	(2.1)	9.0	(0.8)	7.8	(0.7)
Republic of Congo	3075	21.4	(3.4)	21.3	(3.4)	24.4	(6.2)	9.8	(3.7)	21.6	(4.1)	21.2	(3.4)
Senegal	3461	21.9	(1.2)	21.0	(1.4)	26.4	(2.5)	15.9	(3.3)	21.5	(1.6)	22.2	(1.8)
Vietnam	4174	19.6	(2.6)	19.3	(2.7)	22.0	(3.0)	16.1	(3.2)	19.7	(2.5)	19.5	(2.8)
Zambia	4165	16.8	(1.0)	17.0	(1.1)	17.3	(1.8)	12.1	(2.7)	18.8	(1.2)	14.7	(1.2)
Zimbabwe	4290	23.4	(1.0)	22.0	(1.1)	27.1	(2.3)	29.2	(3.8)	24.6	(1.2)	22.2	(1.5)
Middle-income countries													
Bosnia Herzegovina	1031	15.6	(2.1)	14.6	(2.1)	22.6	(4.3)	3.6	(2.0)	13.8	(2.2)	17.6	(3.0)
Brazil	5000	36.6	(1.0)	36.2	(1.1)	40.8	(1.7)	27.0	(2.4)	38.4	(1.2)	34.6	(1.3)
China	3994	10.5	(2.0)	10.9	(2.4)	11.0	(2.1)	8.0	(2.6)	11.2	(1.8)	9.9	(2.3)
Croatia	993	27.1	(1.7)	26.1	(3.0)	31.8	(2.5)	18.7	(3.3)	31.6	(2.4)	20.9	(2.4)
Czech Republic	949	18.2	(1.9)	19.2	(3.7)	19.0	(2.9)	13.9	(4.5)	21.1	(3.3)	14.9	(2.6)
Dominican Republic	5027	22.8	(1.1)	22.9	(1.2)	24.6	(1.9)	16.1	(2.7)	24.0	(1.3)	21.7	(1.7)
Ecuador	5675	22.6	(1.4)	21.7	(1.6)	27.1	(2.3)	17.6	(2.5)	23.3	(1.5)	21.9	(1.8)
Estonia	1020	25.1	(1.9)	22.6	(3.3)	32.6	(2.9)	19.3	(2.7)	26.9	(1.9)	22.9	(2.2)
Georgia	2950	18.4	(1.6)	18.5	(1.9)	22.6	(2.4)	11.8	(1.7)	20.4	(2.2)	16.1	(1.7)
Hungary	1419	24.0	(1.3)	22.7	(1.8)	31.4	(2.3)	14.4	(2.1)	26.5	(1.7)	21.1	(1.8)
Kazakhstan	4499	20.4	(1.8)	17.8	(1.6)	25.5	(2.3)	23.8	(6.9)	22.9	(2.0)	17.7	(2.5)
Latvia	929	15.7	(1.8)	14.0	(2.3)	20.9	(3.9)	12.0	(2.1)	18.3	(2.2)	12.5	(2.5)
Malaysia	6145	25.6	(0.9)	26.9	(1.0)	24.3	(1.3)	17.0	(1.9)	23.7	(1.0)	27.3	(1.2)
Mauritius	3968	21.7	(1.2)	23.4	(1.5)	21.6	(1.8)	10.5	(1.7)	22.0	(1.6)	21.5	(1.9)
Mexico	38746	11.8	(0.3)	11.6	(0.4)	13.5	(0.5)	9.0	(0.7)	13.1	(0.4)	10.4	(0.4)
Morocco	5000	26.0	(1.0)	28.3	(1.3)	24.1	(2.3)	8.5	(1.8)	28.3	(1.2)	23.6	(1.8)
Namibia	4379	15.7	(0.8)	15.2	(1.0)	18.1	(2.1)	13.9	(2.8)	16.9	(1.1)	14.3	(1.2)
Paraguay	5288	38.2	(0.9)	39.0	(1.1)	39.6	(1.7)	24.5	(2.5)	41.7	(1.2)	34.6	(1.3)
Philippines	10083	22.9	(1.3)	22.9	(1.4)	24.7	(1.7)	16.2	(2.1)	24.9	(1.5)	20.9	(1.4)
Russia	4427	22.5	(1.4)	22.5	(1.7)	27.1	(2.3)	17.4	(2.0)	24.4	(1.8)	19.1	(1.7)
Slovakia	2535	25.0	(2.6)	25.0	(2.8)	29.1	(5.3)	11.7	(4.5)	30.4	(3.4)	17.5	(3.2)
South Africa	2629	15.7	(1.3)	15.4	(1.4)	16.8	(2.4)	15.7	(3.1)	18.0	(1.7)	13.2	(1.5)
Sri Lanka	6805	12.0	(0.9)	13.6	(1.1)	10.6	(1.1)	5.9	(0.9)	12.0	(1.1)	12.0	(1.0)
Swaziland	3117	12.3	(1.2)	11.4	(1.3)	13.3	(2.3)	18.4	(4.5)	12.7	(1.4)	11.8	(1.5)
Tunisia	5202	28.0	(1.4)	29.4	(1.6)	29.1	(1.9)	13.7	(2.0)	27.7	(1.5)	28.3	(1.8)
Ukraine	2860	20.2	(1.5)	22.3	(2.0)	19.9	(2.0)	14.9	(2.1)	25.2	(1.7)	14.2	(1.7)
Uruguay	2996	17.3	(1.3)	15.9	(1.5)	24.3	(2.1)	11.0	(1.1)	20.1	(1.5)	14.2	(1.1)
High-income countries													
Finland	1013	43.3	(1.7)	44.9	(2.8)	47.7	(2.7)	32.1	(2.8)	47.4	(2.3)	38.9	(2.5)
France	1008	21.8	(2.5)	14.5	(2.3)	34.0	(5.3)	20.1	(5.3)	23.8	(3.1)	19.6	(3.4)
Ireland	1014	12.8	(1.6)	9.3	(1.6)	17.7	(2.8)	15.9	(3.9)	15.7	(2.2)	9.8	(1.7)
Israel	1536	39.3	(1.6)	38.1	(2.2)	46.3	(3.2)	31.2	(3.5)	38.7	(2.2)	39.9	(2.5)
Luxembourg	700	40.3	(1.9)	39.8	(2.5)	45.2	(3.4)	33.6	(4.8)	43.8	(2.7)	36.7	(2.6)
Norway	984	35.1	(1.5)	30.9	(2.1)	45.0	(2.9)	29.5	(3.2)	30.9	(2.1)	39.4	(2.2)
Portugal	1030	15.1	(1.3)	15.4	(1.7)	17.1	(2.6)	11.8	(2.4)	16.5	(1.8)	13.6	(2.1)
Spain	6373	22.7	(0.8)	23.8	(1.2)	26.7	(1.3)	15.0	(1.1)	25.6	(1.1)	19.7	(1.1)
Sweden	1000	37.0	(3.1)	33.0	(4.1)	46.4	(5.6)	30.7	(6.2)	44.4	(5.2)	30.4	(3.1)
United Arab Emirates	1183	21.2	(3.5)	22.7	(4.0)	17.8	(3.3)	6.0	(4.3)	20.3	(2.9)	21.5	(4.2)

Abbreviation: SE Standard error.

[a] Unweighted N.

Those who answered affirmatively to the question "During the past year, did you provide help to a relative or friend (adult or child), because this person has a long-term physical or mental illness or disability, or is getting old and weak" were considered to be engaged in caregiving activities.

Table 2 Prevalence of caregiving by sample characteristics

				Country income level					
		Overall (58 countries)		Low (21 countries)		Middle (27 countries)		High (10 countries)	
Characteristics	Categories	%	P-value	%	P-value	%	P-value	%	P-value
Age (years)	18-44	19.6	<0.0001	16.6	<0.0001	24.0	<0.0001	21.3	<0.0001
	45-64	21.5		15.4		26.1		32.4	
	≥65	14.7		10.2		16.8		19.8	
Sex	Male	18.7	<0.0001	16.3	0.0968	21.7	<0.0001	21.9	0.0122
	Female	20.5		15.6		25.6		26.6	
Marital status	Married/cohabiting	19.9	0.0199	16.3	0.0027	24.3	0.0108	26.8	0.0019
	Never married	19.4		15.7		23.2		20.6	
	Separated/divorced/widowed	18.3		13.1		21.9		20.3	
Wealth	Poorest	16.5	<0.0001	13.0	<0.0001	20.7	<0.0001	19.4	0.0013
	Poorer	17.9		14.0		22.3		20.6	
	Middle	19.5		15.5		23.9		24.0	
	Richer	20.6		16.4		25.1		25.7	
	Richest	23.9		19.8		27.8		31.1	
Education	No formal	12.7	<0.0001	11.4	<0.0001	22.6	<0.0001	15.7	0.0091
	≤Primary	20.8		18.1		25.2		19.6	
	Secondary	21.7		20.0		22.0		24.6	
	Tertiary	25.6		20.1		27.8		28.9	
Household size	1	17.8	<0.0001	15.1	0.3098	17.8	<0.0001	19.0	0.0130
	2	21.8		14.1		23.8		23.6	
	3-5	20.9		16.1		24.2		25.7	
	≥6	18.0		15.9		24.3		31.4	
Employment	Currently in paid employment	20.3	0.0010	16.3	0.0380	25.5	0.0041	24.7	0.8658
	Not working for pay	19.0		15.2		23.7		24.4	
Disability	No	19.3	<0.0001	15.8	0.1681	23.2	<0.0001	24.0	0.1477
	Yes	21.6		16.8		27.4		27.7	

P-value was calculated by Chi-squared tests.
Those who answered affirmatively to the question "During the past year, did you provide help to a relative or friend (adult or child), because this person has a long-term physical or mental illness or disability, or is getting old and weak" were considered to be engaged in caregiving activities.

Table 3 The association between caregiving (exposure variable) and (a) depression, (b) sleep problems, (c) perceived stress (outcome variables)

	All ages			Age 18-44 years			Age 45-64 years			Age ≥65 years		
(a) **Depression**	OR	95%CI	P-value	OR	95%CI	P-value	OR	95%CI	P-value	OR	95%CI	P-value
Logistic regression												
All countries	1.54	[1.37,1.73]	<0.0001	1.46	[1.29,1.67]	<0.0001	1.80	[1.44,2.26]	<0.0001	1.15	[0.83,1.59]	0.3900
High-income	2.29	[1.46,3.61]	0.0003	1.81	[1.31,2.49]	0.0003	3.15	[1.61,6.17]	0.0008	1.17	[0.74,1.85]	0.4993
Middle-income	1.43	[1.26,1.62]	<0.0001	1.52	[1.28,1.79]	<0.0001	1.39	[1.11,1.75]	0.0047	1.00	[0.70,1.44]	0.9921
Low-income	1.54	[1.28,1.86]	<0.0001	1.39	[1.14,1.70]	0.0011	1.97	[1.38,2.81]	0.0002	1.44	[0.77,2.72]	0.2560
(b) **Sleep problems**	OR	95%CI	P-value	OR	95%CI	P-value	OR	95%CI	P-value	OR	95%CI	P-value
Logistic regression												
All countries	1.37	[1.25,1.50]	<0.0001	1.50	[1.33,1.68]	<0.0001	1.21	[1.03,1.40]	0.0167	1.19	[0.92,1.54]	0.1965
High-income	1.84	[1.44,2.35]	<0.0001	2.88	[1.95,4.26]	<0.0001	1.24	[0.80,1.94]	0.3359	1.46	[1.00,2.12]	0.0475
Middle-income	1.27	[1.11,1.44]	0.0004	1.36	[1.15,1.61]	0.0004	1.16	[0.94,1.43]	0.1617	1.09	[0.77,1.56]	0.6147
Low-income	1.43	[1.24,1.64]	<0.0001	1.53	[1.29,1.83]	<0.0001	1.25	[0.98,1.60]	0.0701	1.25	[0.77,2.03]	0.3609
(c) **Perceived stress**[a]	β	95%CI	P-value	β	95%CI	P-value	β	95%CI	P-value	β	95%CI	P-value
Linear regression												
All countries	3.15	[2.46,3.84]	<0.0001	3.50	[2.68,4.31]	<0.0001	2.52	[1.31,3.74]	<0.0001	2.54	[0.48,4.59]	0.0155
High-income	4.29	[2.23,6.34]	<0.0001	4.03	[0.96,7.10]	0.0101	5.01	[1.65,8.36]	0.0035	5.33	[2.72,7.94]	0.0001
Middle-income	3.08	[2.27,3.89]	<0.0001	3.75	[2.84,4.65]	<0.0001	2.84	[1.30,4.37]	0.0003	-0.57	[-3.37,2.22]	0.6881
Low-income	2.93	[1.86,3.99]	<0.0001	3.19	[1.98,4.39]	<0.0001	1.32	[-0.63,3.27]	0.1851	5.23	[1.38,9.08]	0.0077

Abbreviation: OR Odds ratio; CI Confidence interval.

Those who answered affirmatively to the question "During the past year, did you provide help to a relative or friend (adult or child), because this person has a long-term physical or mental illness or disability, or is getting old and weak" were considered to be engaged in caregiving activities.

All models are adjusted for age, sex, marital status, wealth, highest education attained, household size, employment status, disability, and country.

[a] Brazil, Hungary, and Zimbabwe are not included as information on perceived stress was not collected. The perceived stress score ranged from 0-100 with higher scores indicating higher levels of perceived stress. β-coefficients are reported as the estimates were based on linear regression analyses.

Table 4 The association between number of caregiving activities (exposure variable) and (a) depression, (b) sleep problems, (c) perceived stress (outcome variables)

	Logistic regression						*Linear regression*		
	(a) **Depression**			(b) **Sleep problems**			(c) **Perceived stress**[a]		
	OR	95%CI	P-value	OR	95%CI	P-value	β	95%CI	P-value
All countries[b]	1.16	[1.12,1.21]	<0.0001	1.08	[1.05,1.11]	<0.0001	1.02	[0.80,1.24]	<0.0001
High-income[b]	1.15	[1.06,1.25]	0.0006	1.13	[1.05,1.21]	0.0009	1.41	[0.81,2.01]	<0.0001
Middle-income	1.15	[1.11,1.20]	<0.0001	1.07	[1.03,1.11]	0.0002	1.02	[0.76,1.29]	<0.0001
Low-income	1.17	[1.10,1.25]	<0.0001	1.09	[1.05,1.14]	0.0001	0.97	[0.65,1.30]	<0.0001

Abbreviation: OR Odds ratio; CI Confidence interval

The number of caregiving activities (personal care, medical care, household activities, supervision, transport/mobility) ranged from 0-5. This variable was included in the model as a continuous variable.

[a] Brazil, Hungary, and Zimbabwe are not included as information on perceived stress was not collected. The perceived stress score ranged from 0-100 with higher scores indicating higher levels of perceived stress. β-coefficients are reported as the estimates were based on linear regression analyses.

[b] Eight high-income countries are not included in the analysis as there was no information on type of caregiving activity. Thus, only two high-income countries are included (Spain and United Arab Emirates).

All models are adjusted for age, sex, marital status, wealth, highest education attained, household size, employment status, disability, and country.

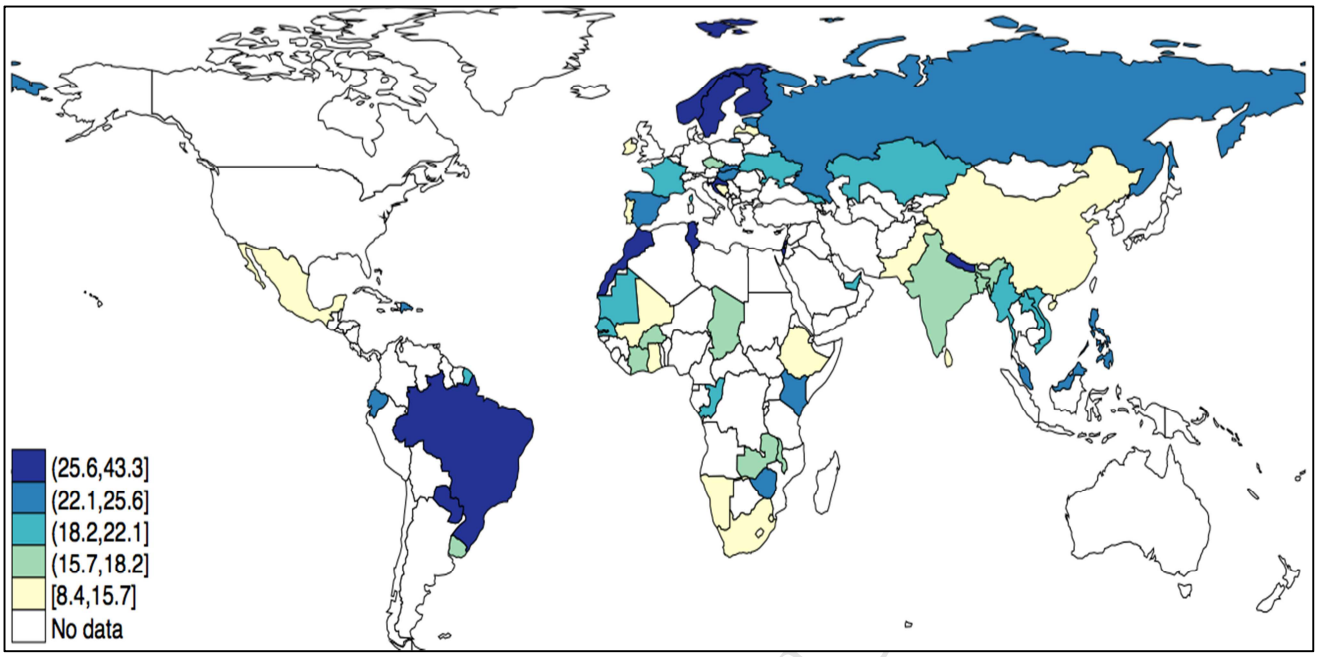

Figure 1 Prevalence of caregiving by country

Those who answered affirmatively to the question "During the past year, did you provide help to a relative or friend (adult or child), because this person has a long-term physical or mental illness or disability, or is getting old and weak" were considered to be engaged in caregiving activities.

Highlights

- Approximately one fifth of the adult population in the 58 countries studied were engaged in informal care with particularly high rates observed in high-income countries.
- Caregivers had a significantly increased likelihood of having depression, sleep problems, and higher levels of perceived stress, particularly in high-income countries.
- Interventions and policies to address the mental health burden of caregivers are indispensable to maintain sustainable and effective care practices.

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